GSFC Software Process Overview

Presented by the

Software Process Improvement (SPI) Project

GSFC

- **Purpose: Provide a walkthrough of top-priority Mission Software process assets**

- **Objective: Help you understand:**
  - **What's in a process description**
  - **How the process library is organized**
  - **What tasks are required for selected processes**
  - **Where to find support assets for each process addressed**
  - **Where to find assets in the Process Asset Library (PAL)**

http://software.gsfc.nasa.gov/process.cfm
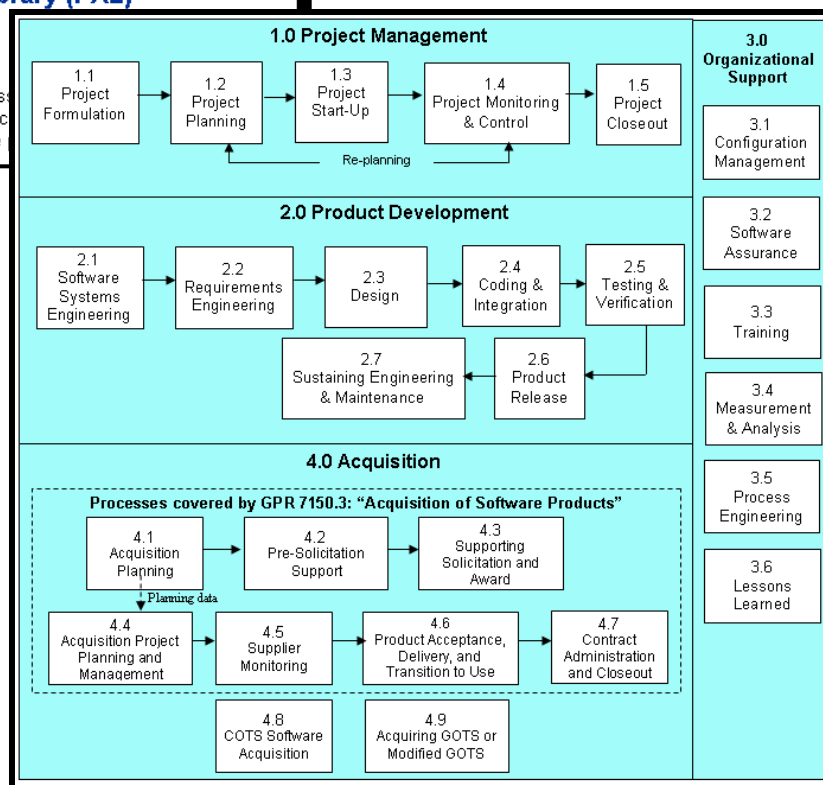
Why This Process Overview?

- **To make teams aware of the defined processes**
  - **Although some are labeled "ISD" processes these have been elevated to applicability across all mission software projects at Goddard**

- **To review the steps of key management processes**
  - **Project Planning**
  - **Project Monitoring and Control**
  - **Risk Management**
  - **Requirements Management**
  - **Configuration Management**
  - **Process and Product Quality Assurance**
  - **Measurement and Analysis**
  - **Software Acquisition (Supplier Agreement Management)**

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Go to http://software.gsfc.nasa.gov/process.cfm ...

then scroll down for the process hierarchy

Process Description Content

- **Purpose**
- **Scope**
- **Context**
- **Roles and Responsibilities**
- **Inputs**
- **Entry Scenarios**
- **Entry Criteria**
- **Exit Criteria**

- **Outputs**
- ***Major Task (list)***
- ***Major Task Description***
- **Measures**
- **Tools**
- **Training**
- **References**
- **QMS Records**

Helps you formulate your approach for managing and conducting your development or maintenance effort.
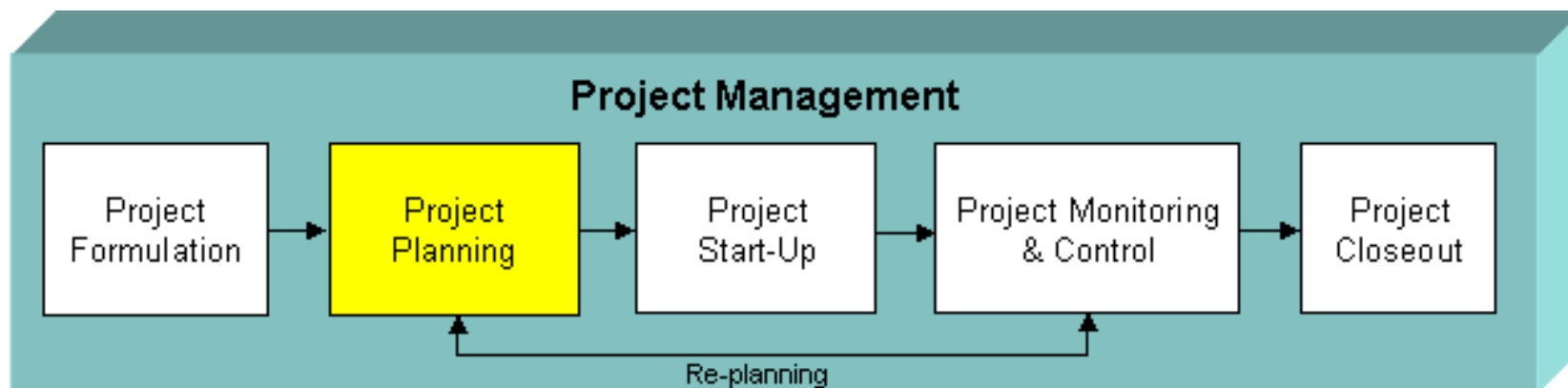
Planning the schedule, budget, staffing, and key activities of a project throughout its lifetime. Includes later re-planning in response to events such as new requirements or delayed hardware deliveries

Project Planning Tasks

Tasks performed sequentially, iteratively, or in parallel

```
[Identify deliverables and dependencies] → [Identify development and/or acquisition strategy] → [Define management and technical approaches]
                                                                                                              ↓
[Develop the Work Breakdown Structure (WBS)] → [Develop the work schedule] → [Estimate product size, effort, and cost]
                                                                                                              ↓
[Define the organization and resources needed] → [Develop management strategies (e.g., Risk, DM, M&A, Training, and Stakeholders)] → [Write the Software Management Plan/Product Plan*]
                                                                                                              ⋮
                                                                                           [Modify the Software Management Plan/Product Plan]
```

Review associated plans for consistency.

Project Management – Project Monitoring and Control Process

Shows you how to assess your project's progress so you can take corrective actions when performance deviates from your plan.

Project Management

| Project Formulation | → | Project Planning | → | Project Start-Up | → | Project Monitoring & Control | → | Project Closeout |

Re-planning
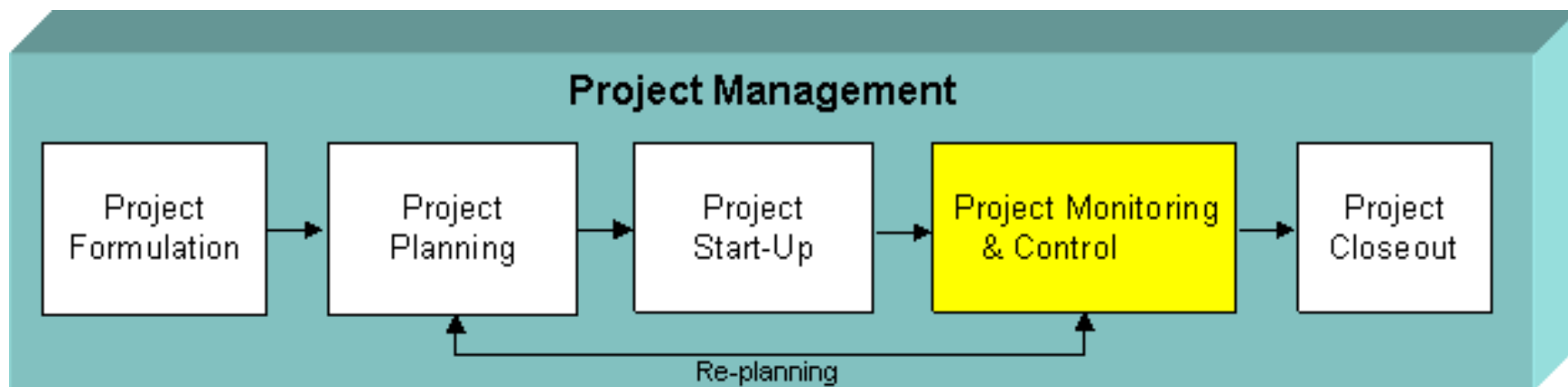
Tracking the performance of projects against the current management plans and controlling variances from the plan

Project Monitoring and Control Tasks

Tasks performed continuously

Monitor software project activities and resources	**Monitor work products and project data***	**Monitor software acquisition**	**Monitor commitments**

Monitoring includes data management, stakeholder involvement, training, and risk elements of the software project as you go.

Tasks performed as needed

Manage corrective actions	**Generate management reports and reviews**	**Conduct milestone reviews**	**Document lessons learned**
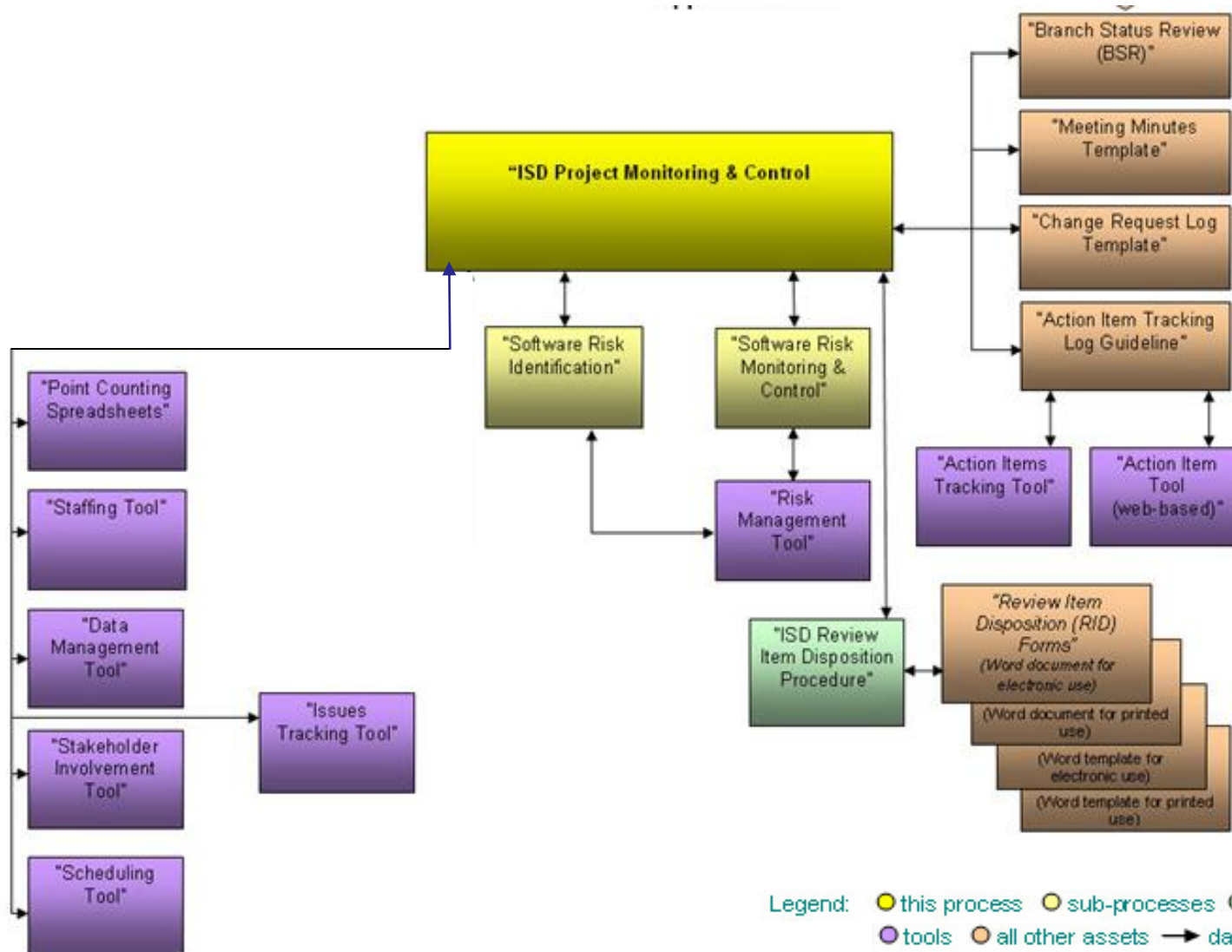
Helps you minimize the impact of risks on cost, schedule, and quality of your software project products.

Project Management

| Project Formulation | Project Planning / **Risk Identification** | Project Start-Up | Project Monitoring & Control / **Risk Monitoring & Control** | Project Closeout |

Re-planning
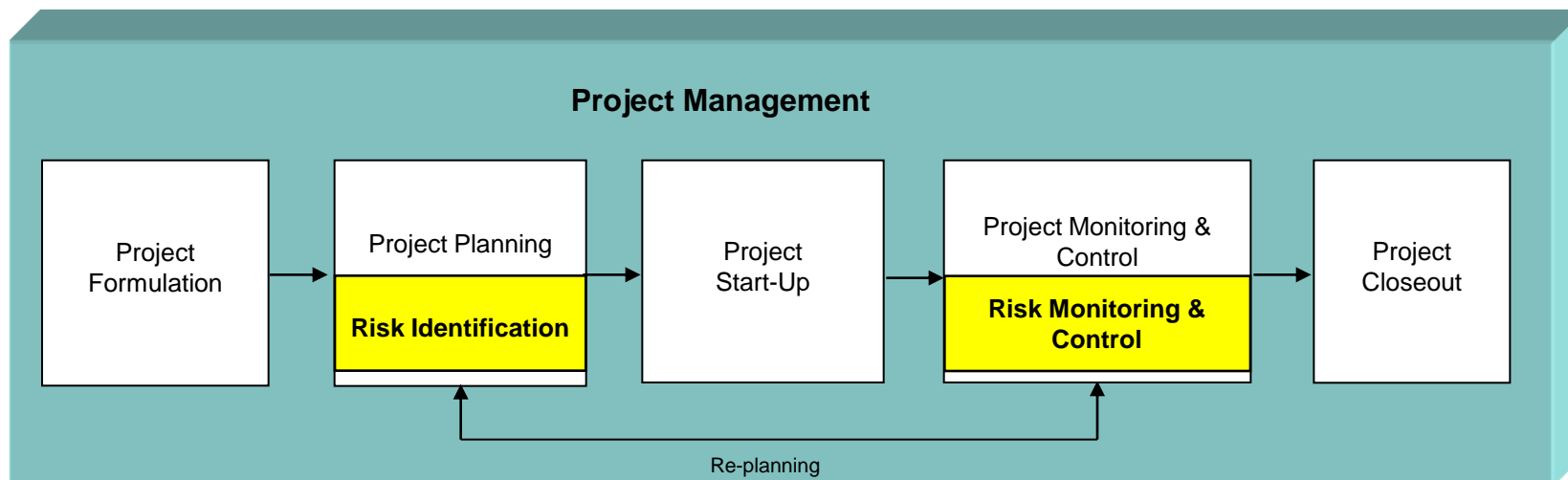
Identifying project areas of risk and then managing those risks to avoid or minimize impacts to the project

Risk Identification Tasks

As you begin risk identification, establish a risk strategy* and identify risk sources and categories

*Risk strategy includes who will do it, the frequency of risk analysis, how risks will be elevated, and when mitigation plans are required

Tasks performed sequentially and iteratively

```
Identify risks → Classify risks → Develop mitigation & contingency strategies → Create Risk Management Plan
                                                                                        │
  ┌─────────────────────────────────────────────────────────────────────────────────────┘
  │
  → Record risks in Risk Management Database → Get Risk Management Plan approval → Report risks and/or enter into Project-level risk tool
```

Risk Monitoring & Control Tasks

Tasks performed sequentially and iteratively

```
┌─────────────────────┐      ┌──────────────────────────┐
│   Analyze risks      │ ───► │   Analyze, update,       │
│ (on a regular basis) │      │      document            │
│                      │      │ mitigation/contingency   │
│                      │      │      strategies          │
└─────────────────────┘      └──────────────────────────┘

┌──────────────────────────┐      ┌──────────────────────────┐
│   Implement risk         │ ───► │   Report updated risks    │
│ mitigation/contingency   │      │  and enter into Risk      │
│      strategies          │      │  Management Database      │
└──────────────────────────┘      └──────────────────────────┘
```
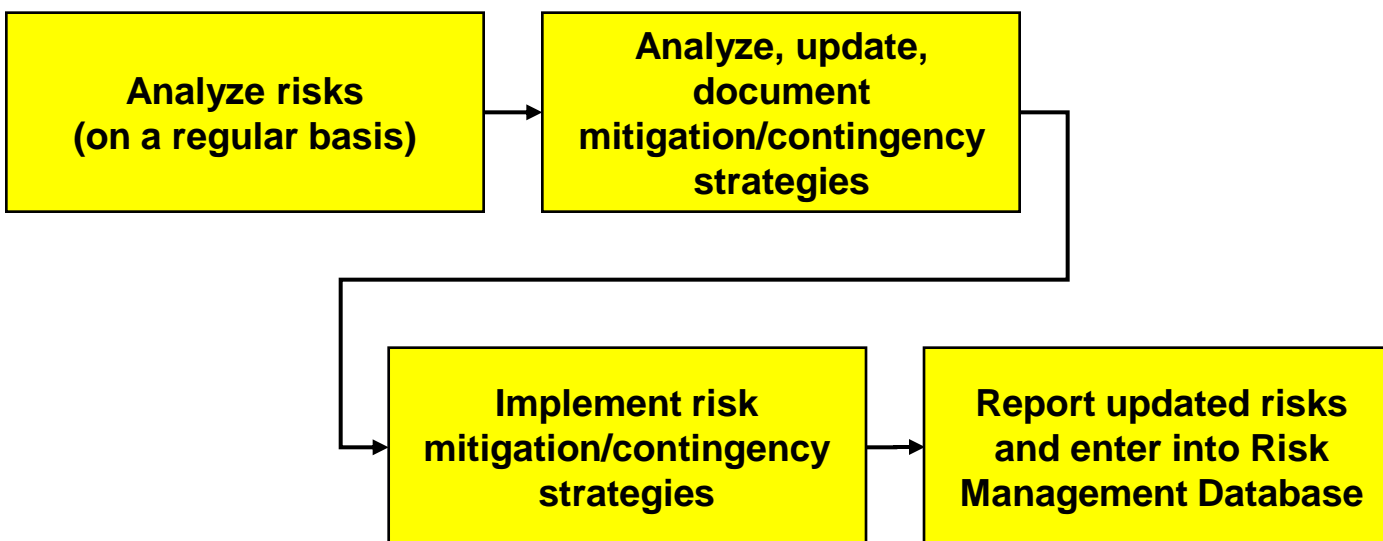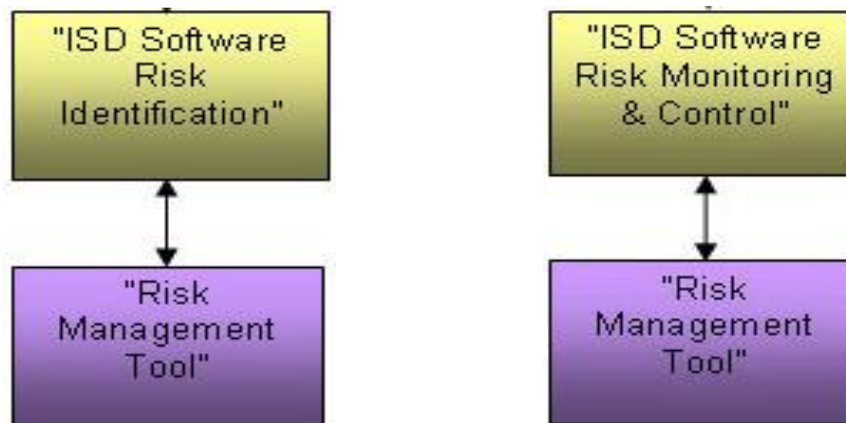
Risk Management – Related Assets

Keeps software project requirements change under control and lets you avoid unintended scope growth.

Product Development
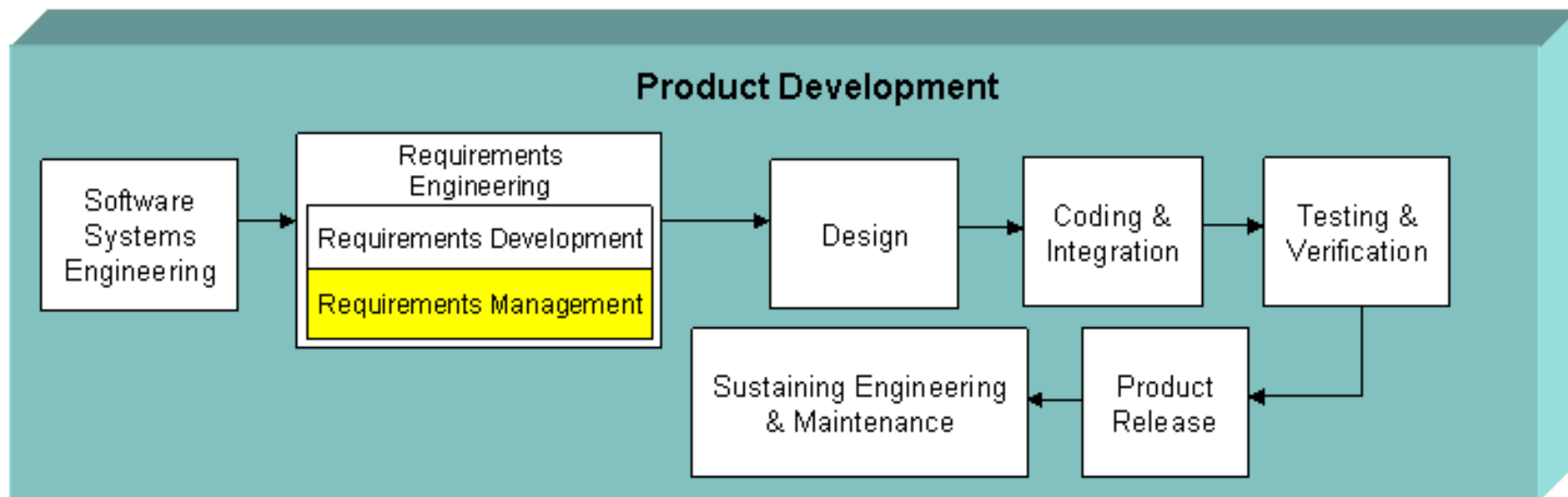
Managing changes to the requirement through understanding potential impacts of proposed changes and obtaining approval and resources for their implementation

Requirements Management Tasks

Tasks performed sequentially and iteratively

```
┌──────────────┐    ┌──────────────┐    ┌──────────────┐    ┌──────────────┐
│   Analyze    │    │  Prepare     │    │ Obtain change│    │   Generate   │
│  requirement │───▶│  impact      │───▶│   request    │───▶│   changed    │
│change request│    │  statement   │    │   approval   │    │documentation │
└──────────────┘    └──────────────┘    └──────────────┘    └──────────────┘

┌──────────────┐    ┌──────────────┐    ┌──────────────┐
│Verify changed│    │Validate      │    │  Update and  │
│requirements, │───▶│changed       │───▶│  distribute  │
│specifications│    │requirements, │    │documentation*│
└──────────────┘    │specifications│    └──────────────┘
                    └──────────────┘
```
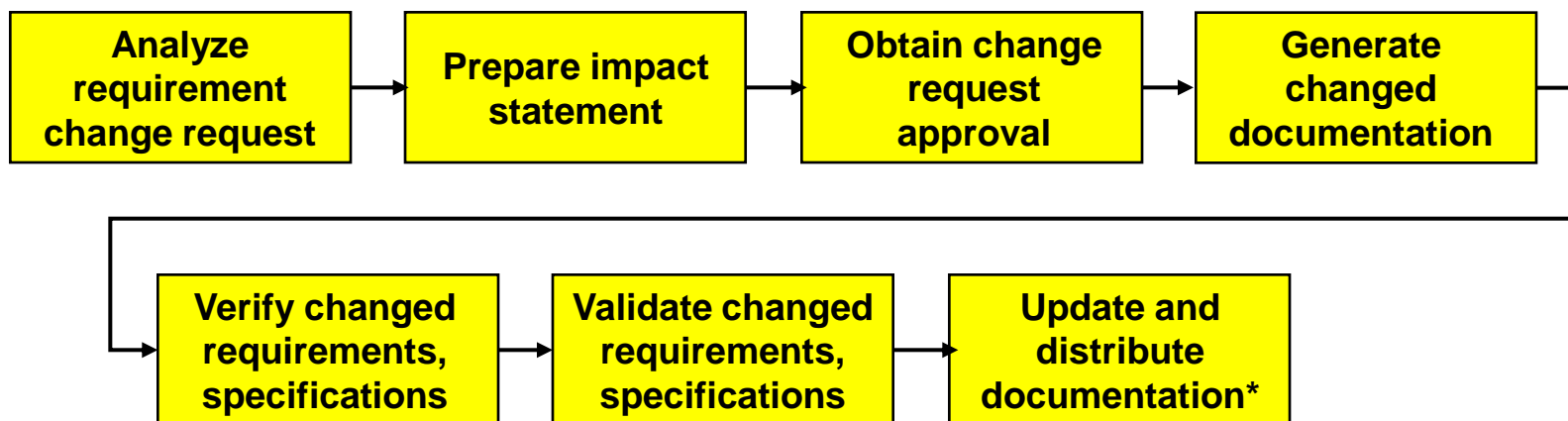
Don't forget to update the requirements traceability documentation

Requirements Management – Related Assets
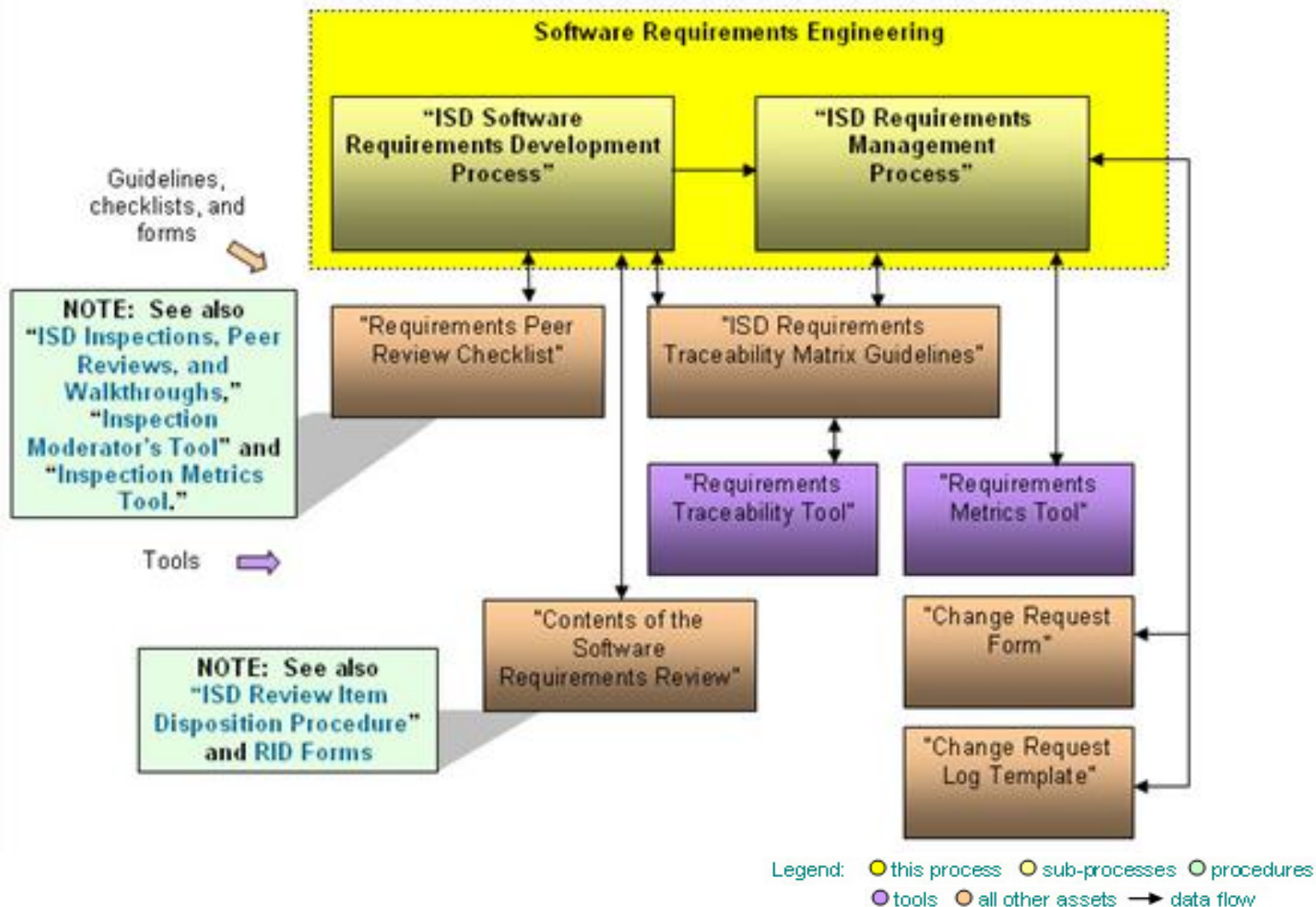
- **Rational RequisitePro – Requirements management aid:**

  http://www-306.ibm.com/software/awdtools/reqpro/

- **MKS – Requirements management tool:**
  http://www.mks.com/

- **Rational DOORs – Requirements definition and management aid:**

  http://www-01.ibm.com/software/awdtools/doors/productline/

- **Teamcenter (formerly SLATE) – Free Requirements tool from Siemens:**

  http://easyweb.easynet.co.uk/~iany/other/vendors.htm

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Helps you maintain the integrity of work products.
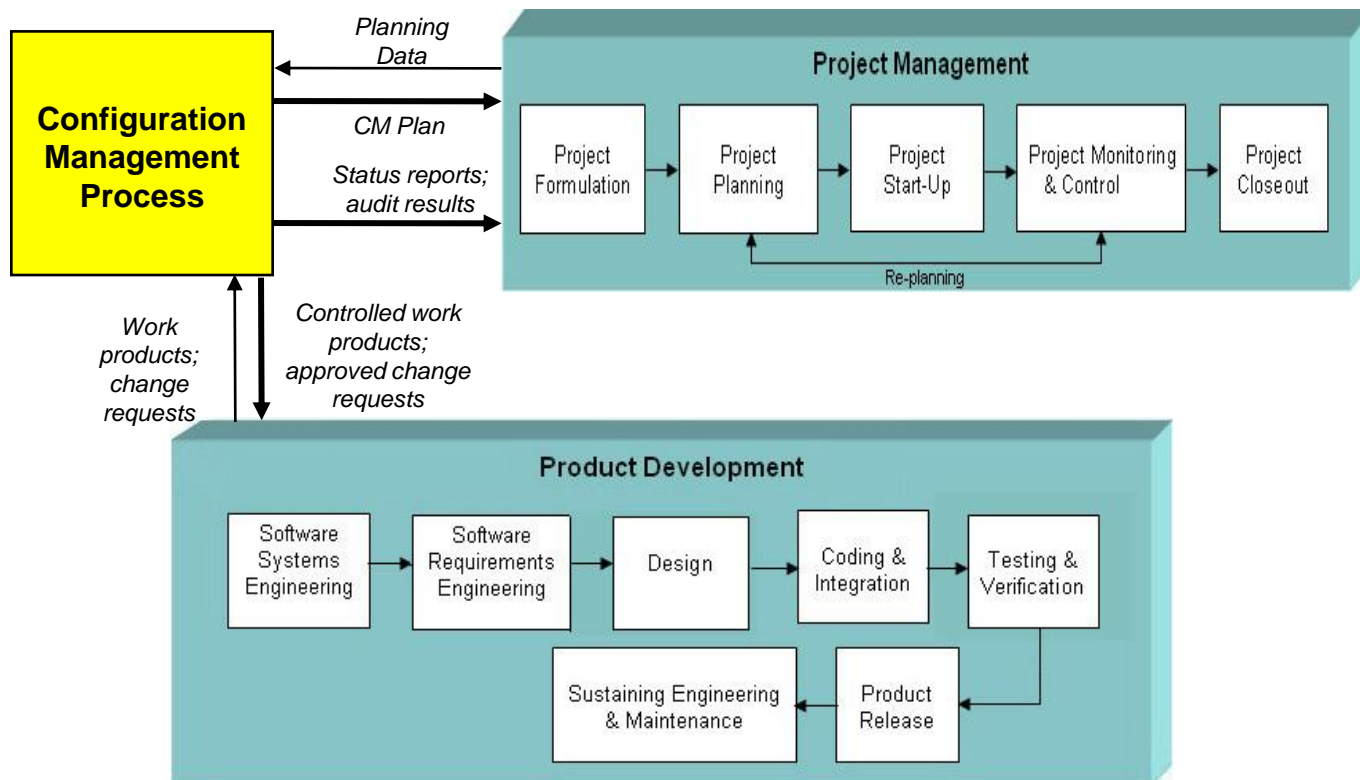
Maintaining the integrity of the system as it is under development using requirements control, change control, and version control

Configuration Management Tasks

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Tasks performed sequentially during planning and startup
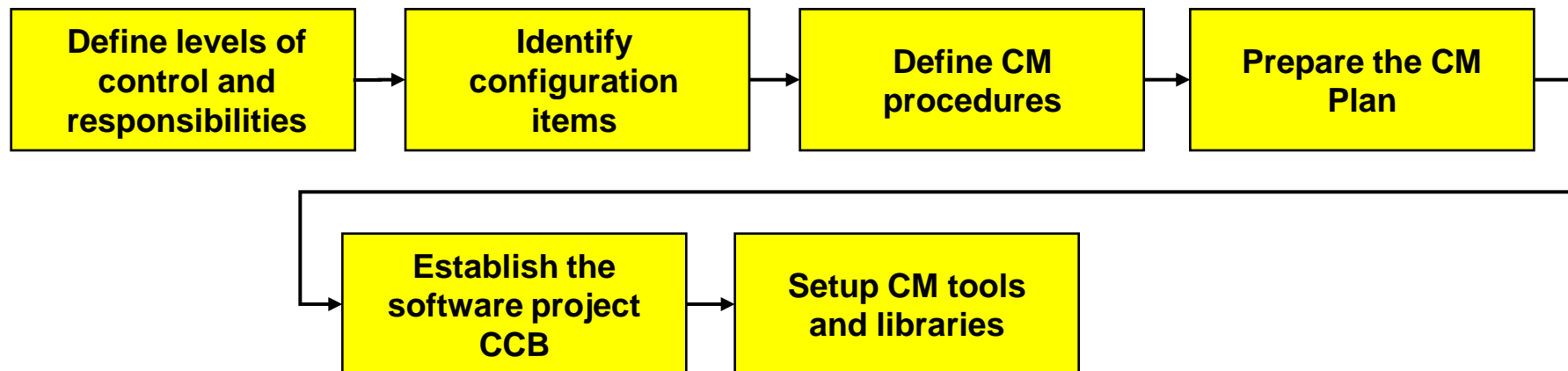
| Define levels of control and responsibilities | → | Identify configuration items | → | Define CM procedures | → | Prepare the CM Plan |

| Establish the software project CCB | → | Setup CM tools and libraries |

Tasks performed sequentially and iteratively
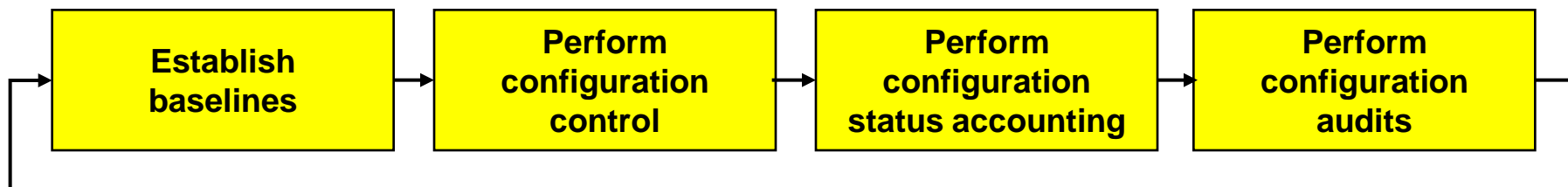
| Establish baselines | → | Perform configuration control | → | Perform configuration status accounting | → | Perform configuration audits |
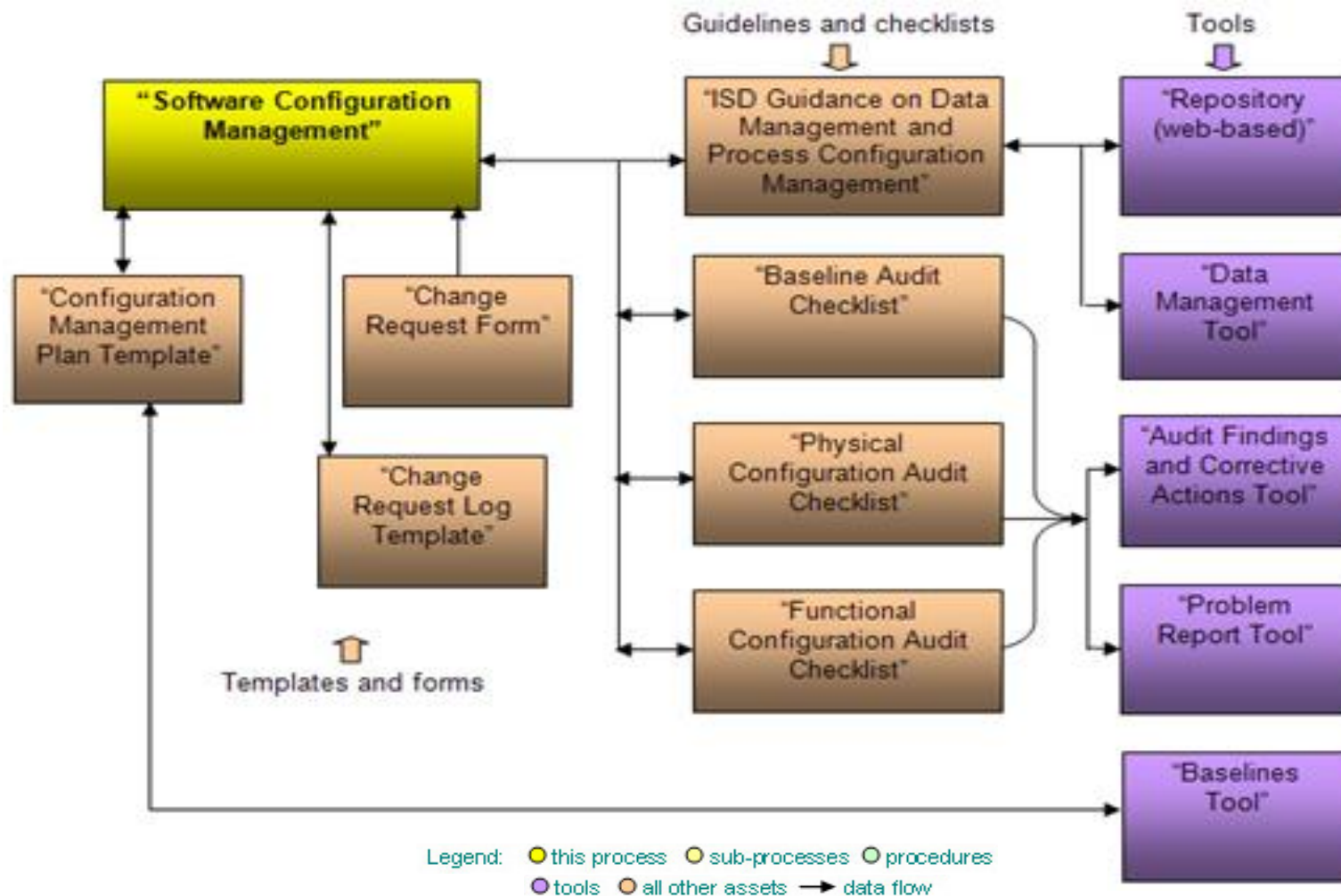
Organizational Support - Software Assurance Process

Helps you ensure that software life cycle processes and products conform to requirements, standards, and procedures.

- **Software Assurance begins during mission formulation**

- **The Office of Systems Safety and Mission Assurance (OSSMA), Code 300, nominally supports Class B and Class C software**

- **Software Quality (SQ) support is responsible for *objective evaluation of adherence* to all Process and Product Quality Assurance (PPQA) requirements**

- **Software Assurance is also supported by the Independent Verification and Validation Facility (IV&V)**

- **Software projects work in concert with these organizations**
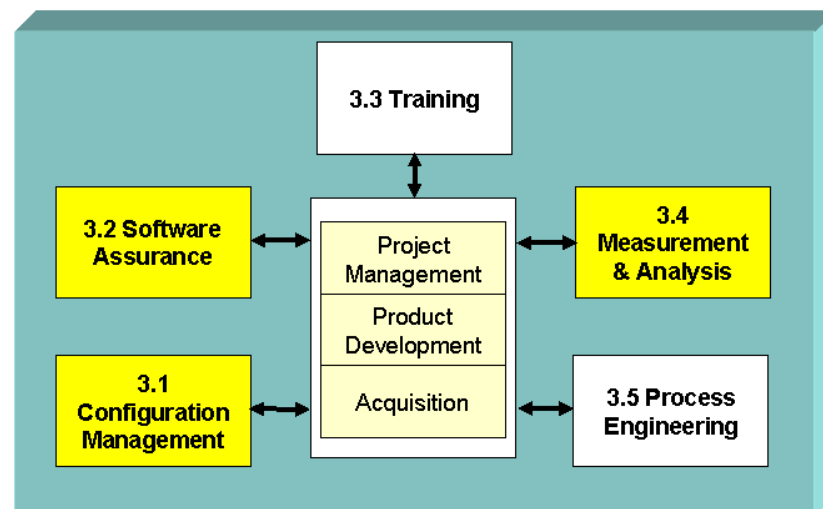
Objective evaluation that assures that a project's processes and products are in conformance with organization standards

Software Quality Tasks – Code 300

Software Quality support – sequential and iterative

```
┌─────────────────┐     ┌─────────────────┐     ┌─────────────────┐
│  Develop the    │ →   │ Objectively     │ →   │  Communicate    │
│ Software Quality│     │ evaluate        │     │   software      │
│     Plan        │     │ processes and   │     │ assurance status│
│                 │     │  products       │     │                 │
└─────────────────┘     └─────────────────┘     └─────────────────┘
```
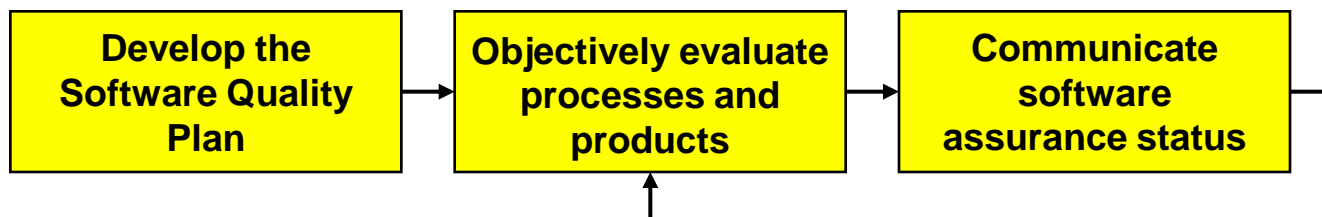
IV&V support (if funded) – sequential and iterative

```
┌──────────────┐   ┌──────────────┐   ┌──────────────────┐   ┌──────────────┐
│ Conduct an   │ → │ Develop the  │ → │ Conduct reviews  │ → │ Communicate  │
│ IV&V start-up│   │  IV&V Plan   │   │ and evaluations  │   │  software    │
│ assessment   │   │              │   │ of selected      │   │ assurance    │
│              │   │              │   │ software*        │   │ status       │
└──────────────┘   └──────────────┘   └──────────────────┘   └──────────────┘
```
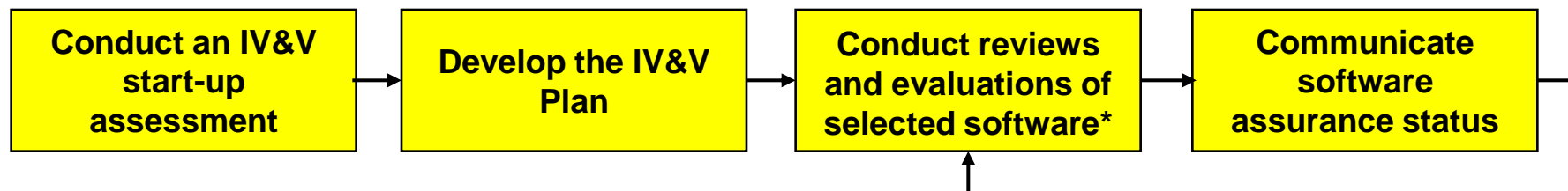
*Software selected and IV&V funded by Headquarters

If Not Supported By Code 300 …

Tasks performed sequentially and iteratively

| Identify objective SQ person(s) for software project | → | Plan and document SQ activities | → | Objectively evaluate processes and products | → | Communicate software quality status |

NOTE: For the purposes of this web page, assets are limited to the discipline of Software Quality Assurance. Visit the **GSFC Software Assurance Website** for additional assets and information on all Software Assurance disciplines, incl. software safety, reliability, verification and validation (V&V) and independent V&V.
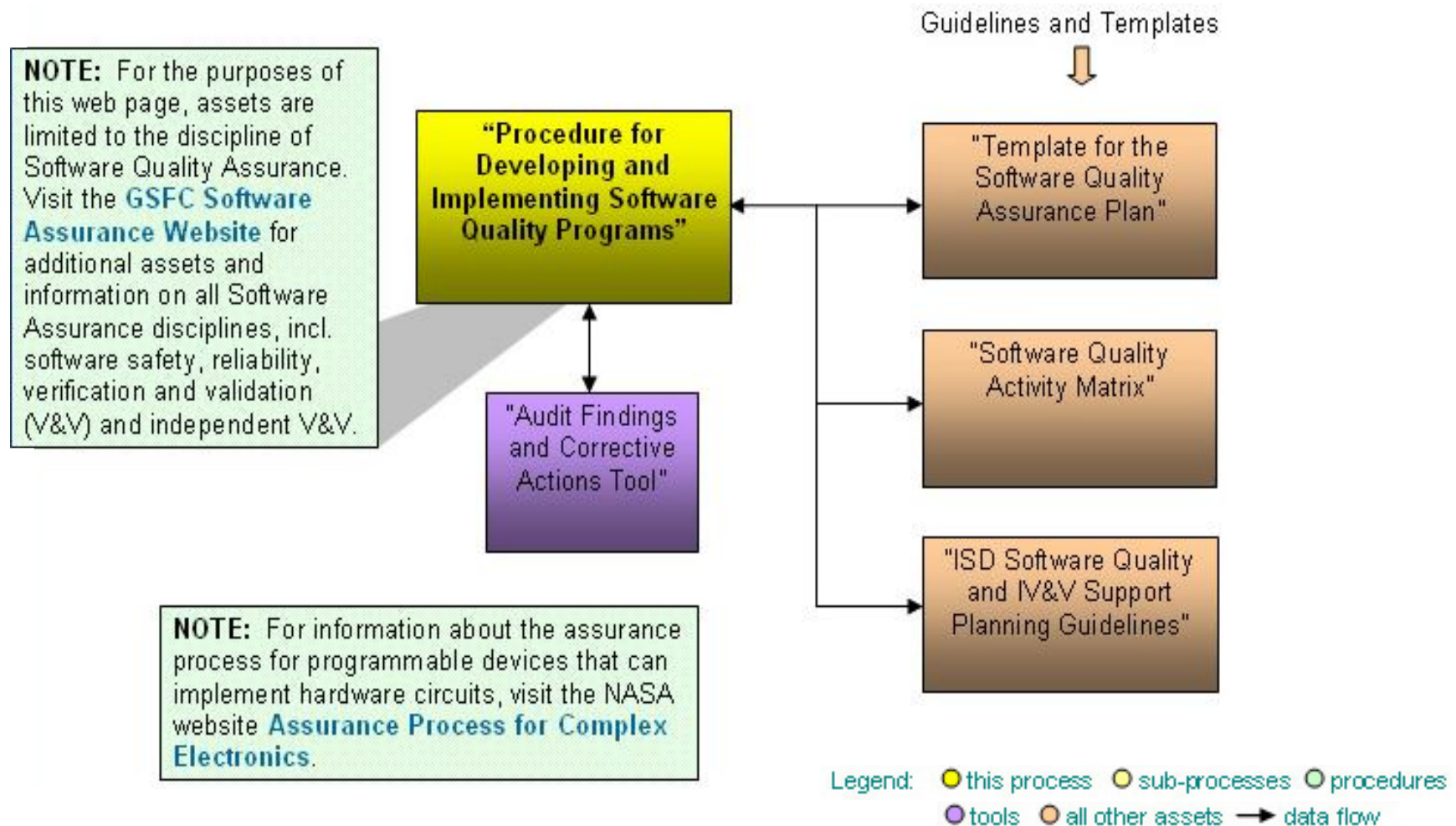
Guidelines and Templates

"Procedure for Developing and Implementing Software Quality Programs"

"Template for the Software Quality Assurance Plan"

"Software Quality Activity Matrix"

"Audit Findings and Corrective Actions Tool"

"ISD Software Quality and IV&V Support Planning Guidelines"

NOTE: For information about the assurance process for programmable devices that can implement hardware circuits, visit the NASA website **Assurance Process for Complex Electronics**.

Legend: ● this process ● sub-processes ● procedures
● tools ● all other assets → data flow

- **Other Code 300 Assets:**

  - **Code 300 Software Quality Processes**

    http://sw-assurance.gsfc.nasa.gov/disciplines/quality/index.php

  - **Product Checklists**

    http://sw-assurance.gsfc.nasa.gov/disciplines/quality/index.php

  - **Software Quality Engineering Repository Database (SQERD) (*ID required for log-in*)**

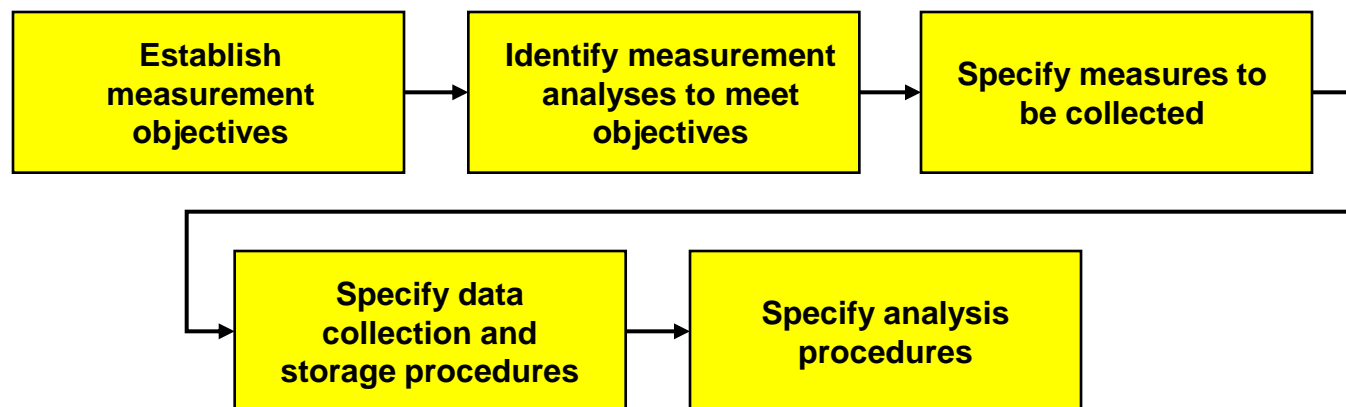   **https://sqerd.gsfc.nasa.gov/**

Helps collection and analysis of metric data to support project management and process improvement.
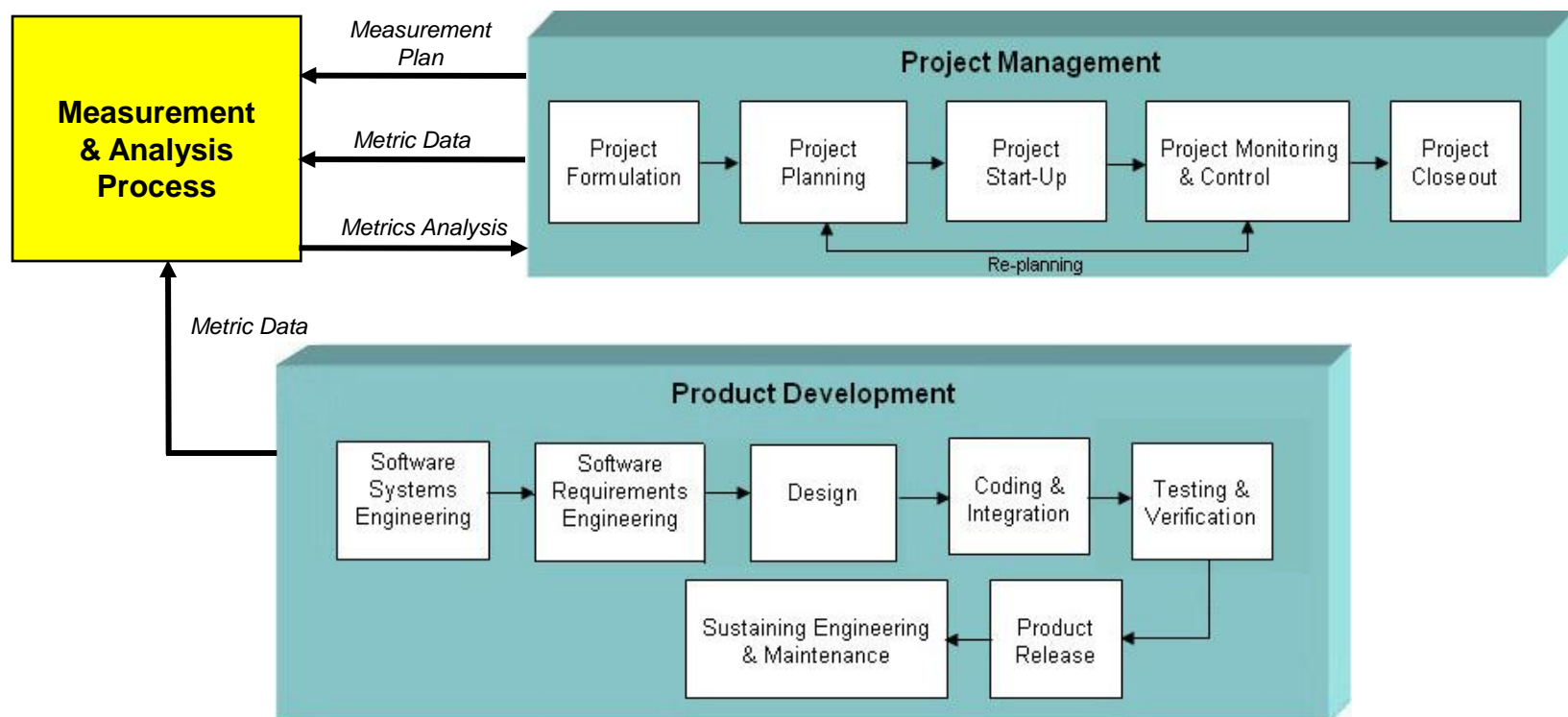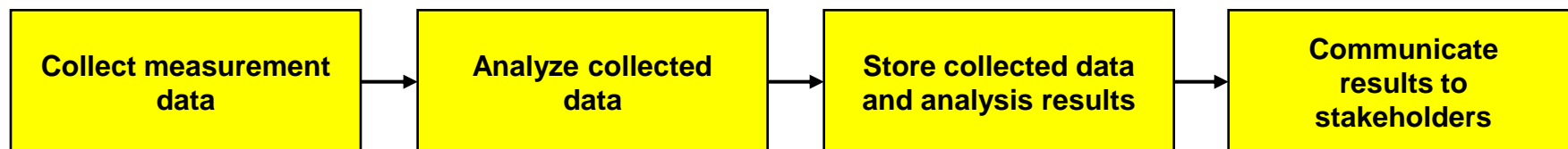

Collection and analysis of project data in support of project management and organizational improvement
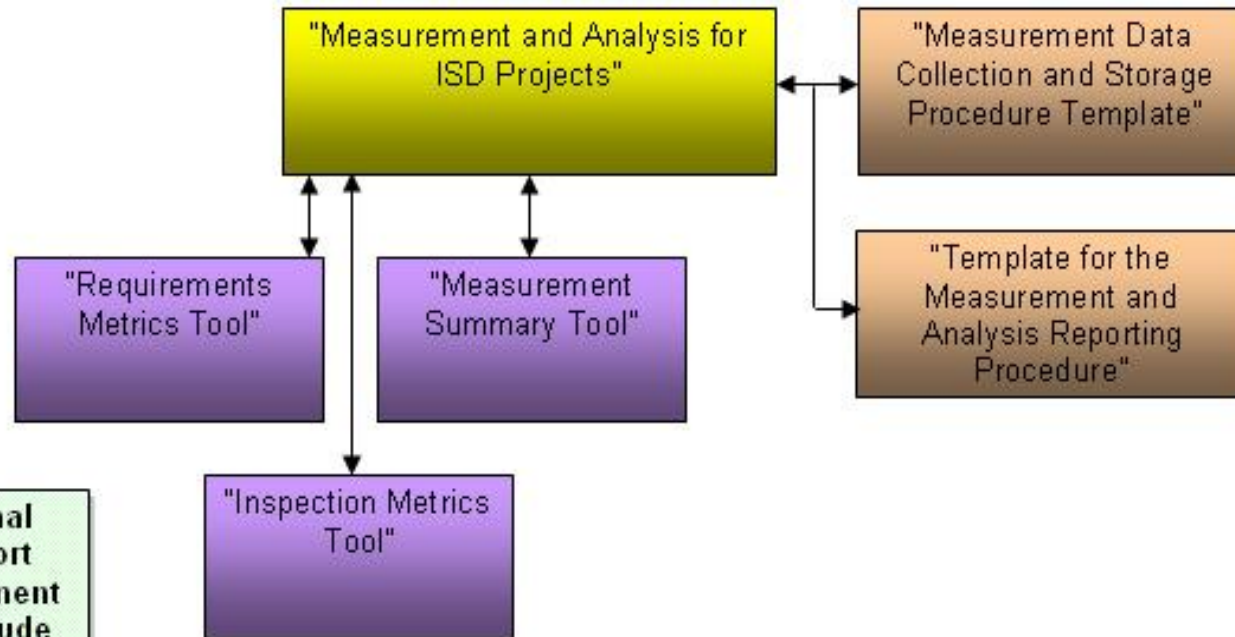
Measurement and Analysis Tasks

Tasks performed sequentially during planning

```
┌─────────────────┐    ┌─────────────────┐    ┌─────────────────┐
│   Establish     │───▶│ Identify        │───▶│ Specify measures│
│   measurement   │    │ measurement     │    │ to be collected │
│   objectives    │    │ analyses to meet│    │                 │
│                 │    │ objectives      │    │                 │
└─────────────────┘    └─────────────────┘    └─────────────────┘
        ┌──────────────────┐    ┌─────────────────┐
        │  Specify data    │───▶│ Specify analysis│
        │  collection and  │    │ procedures      │
        │  storage         │    │                 │
        │  procedures      │    │                 │
        └──────────────────┘    └─────────────────┘
```

Tasks performed sequentially and iteratively

```
┌─────────────────┐  ┌─────────────────┐  ┌─────────────────┐  ┌─────────────────┐
│ Collect         │─▶│ Analyze         │─▶│ Store collected │─▶│ Communicate     │
│ measurement     │  │ collected data  │  │ data and        │  │ results to      │
│ data            │  │                 │  │ analysis results│  │ stakeholders    │
└─────────────────┘  └─────────────────┘  └─────────────────┘  └─────────────────┘
```

Measurement and Analysis – Related Assets

Measurement and Analysis – Other Related Assets

- **GSFC Software Measurement Program Implementation Plan** *(from Measures tab at* **http://software.gsfc.nasa.gov/metrics.htm***)*

- **Standards, Procedures, Guidelines, Templates, and Checklists** *(from Process Asset Library tab)*
  - **Branch Status Review Template (1.4.3.4)**
  - **Software Management Plan/Product Plan Boilerplate Tool, measurement section (1.2.6.2)**

- **SPI Tools that support collection of metrics**
  - **SPI Staffing Tool (1.2.2.3)**
  - **SPI Point Counting Tool (1.4.2.1)**
  - **SPI Problem Report Tool (2.5.2.3)**

Acquisition Process

- **The acquisition process is being defined in GPR 7150.3, which is to be released soon**

- **It applies to projects procuring classes A, B, C, D, and E software, services, and related items**
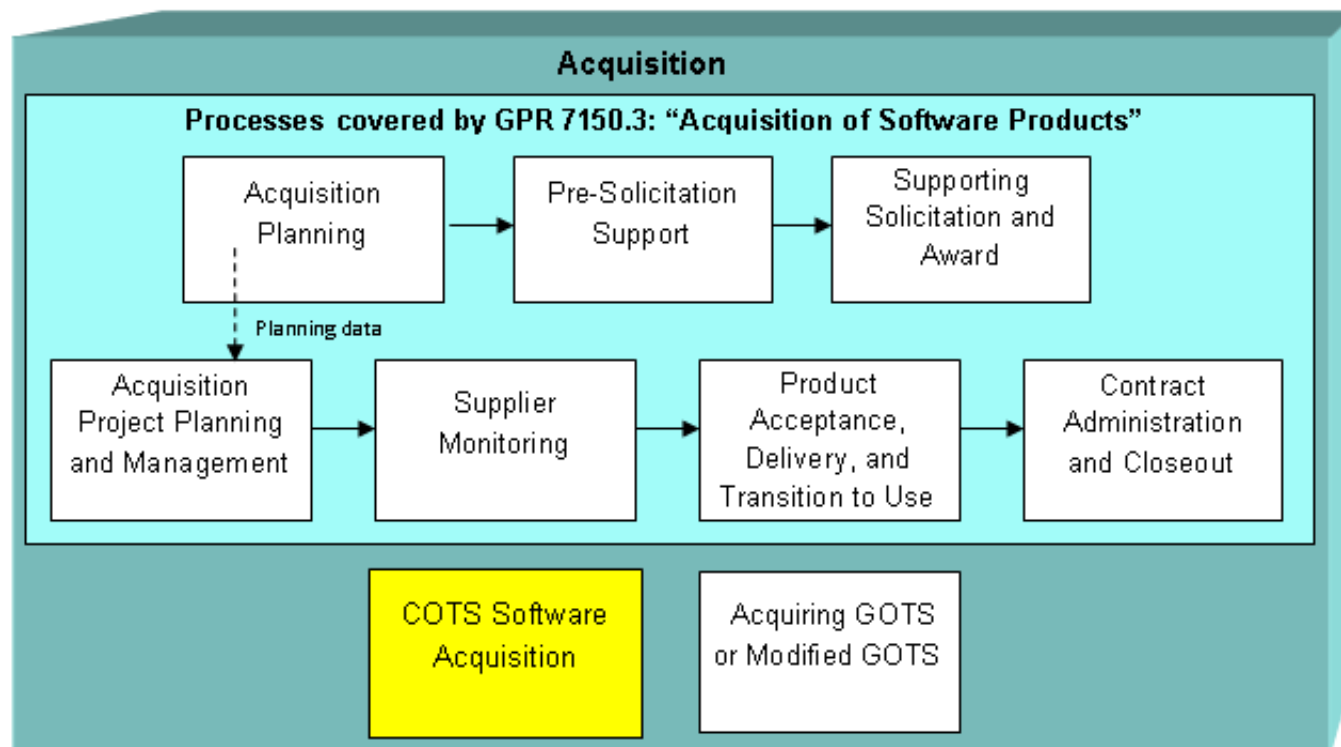
Acquisition Type

- **Acquisition type includes both acquisition method and contract vehicle**
  - **Acquisition method:**
    - Simplified Acquisition
    - Full Acquisition
  - **Contract Vehicle:**
    - Purchase Order
    - Credit Card Purchase
    - Task Order
    - New Contract
    - Modification to existing contract

Acquisition Method

- **Simplified Acquisition** – generally up to $100,000 but can go up to $5,000,000 for OTS hardware and software
  - **Simplified** Acquisition for custom software or services may be competitive or sole source
  - Micro purchases have a value of up $3000, usually done with an authorized government credit card (does not require competitive bids)
- **Full Acquisition** – for acquisition of custom software, services, OTS products, and supplies needed by a software development project that exceed Easy Acquisition limits

Acquisition Method	$0 - $3000	$0 - $100,000	$100,000 - $5,000,000	Over $5,000,000
Simplified Acquisition - COTS	Can Be Used	Can Be Used	Can Be Used	Can NOT Be Used
Simplified Acquisition - Custom S/W, Services	Can Be Used	Can Be Used	Can NOT Be Used	Can NOT Be Used
Full Acquisition	Can Be Used	Can Be Used	Can Be Used	Can Be Used

- **Handbook on credit card purchases**

  http://code210.gsfc.nasa.gov/hqproc/HQPCardHandbook.doc

- **P-Card log file (url is in the handbook)**

		Job Order Number:									
Item Number	Call Number	Purchase Date	Vendor Name/Address	Item Description	Quantity	Price Each	Total Price	Shipping Costs	Received Date	Tag # for ADP	Certification Date(ADP)
1							$0				
2							$0				
3							$0				
4							$0				
5							$0				

- **COTS Software Acquisition Process (4.8)**

- **Software Acquisition Management Plan (SAMP) Template – coming soon**

Summary

GSFC

- **Use the PAL at**

  http://software.gsfc.nasa.gov/

- **Talk to the SPI Group if you need assistance or want to tailor the processes**
  - **Sally Godfrey – SPI Project Manager**

    Sara.H.Godfrey.1@gsfc.nasa.gov

  - **Amy Morusiewicz – SPI Deputy Project Manager**

    Amalia.P.Morusiewicz@nasa.gov

Questions

Acronyms

- **CCB – Configuration Control Board**
- **CM – Configuration Management**
- **COTS – Commercial Off-the-Shelf**
- **DM – Data management**
- **GPR – Goddard Procedural Requirements**
- **ISD – Information System Division**
- **IV&V – Independent Verification and Validation**
- **M&A – Measurement and Analysis**
- **OSSMA – Office of Systems Safety and Mission Assurance**
- **OTS – Off-the-Shelf**
- **PAL – Process Asset Library**
- **PPQA – Process and Product Quality Assurance**
- **SPI – Software Process Improvement**
- **SQ – Software Quality**
- **SQERD – Software Quality Engineering Repository Database**
- **WBS – Work Breakdown Structure**